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Ranunculus luanchuanensis (Ranunculaceae), a new species from Henan, China

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Abstract

Ranunculus luanchuanensis (Ranunculaceae), a new species from Laojun Shan in Luanchuan county, Henan province, central China, is here illustrated and described. It is morphologically similar to *R. limprichtii* in having 3-lobed and subreniform basal leaves, 3-lobed cauline leaves, and small flowers with reflexed and caducous sepals, but differs by having slender and basally slightly thickened roots (vs. fusiform), prostrate stems (vs. erect), obliquely ovoid and glabrous carpels and achenes (vs. widely ovoid and puberulous), longer styles in the carpels (ca. 1.2 mm vs. 0.6–0.8 mm) and achenes (ca. 1.8 mm vs. 0.6–0.8 mm), and glabrous receptacles (vs. sparsely puberulous). *Ranunculus luanchuanensis*, currently known only from its type locality, is geographically isolated from *R. limprichtii*, a species widely distributed in Gansu, Qinghai, Sichuan, Xizang (Tibet) and Yunnan, China. The distribution map of this new species and its putative closest ally, *R. limprichtii*, is also provided.

Keywords

Asia, buttercups, Ranunculales, *Ranunculus limprichtii*

Introduction

Ranunculus L., with ca. 600 species, is the largest genus in the Ranunculaceae and is widely distributed in all continents (Tamura 1995; Hörandl et al. 2005; Paun et al. 2005; Hörandl and Emadzade 2012). More than 150 species and 30 varieties of *Ranunculus* are currently recognized in China, one of the centers of species diversity for the genus (Wang 1995a, b,

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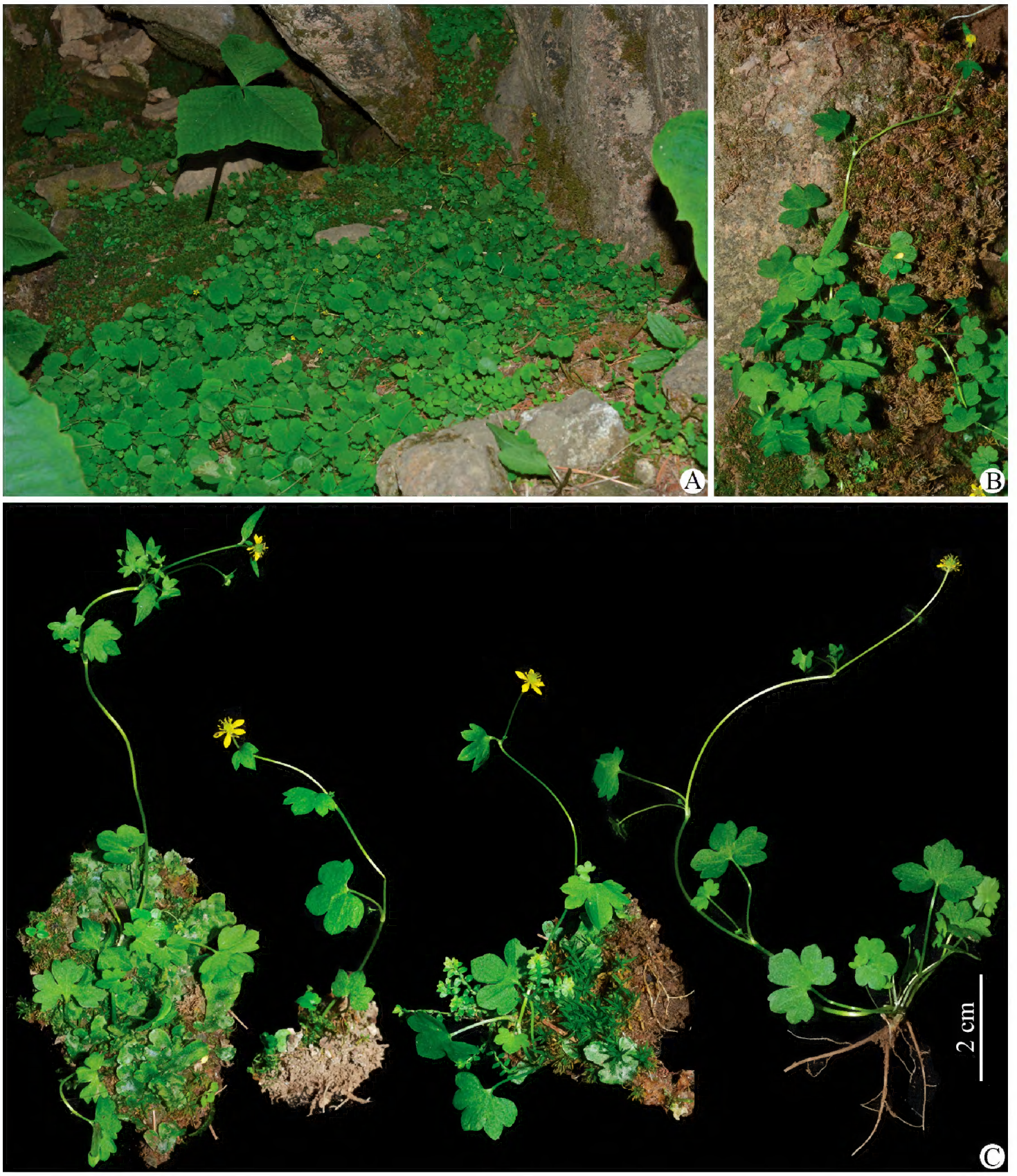

Figure 1. *Ranunculus luanchuanensis* sp. nov. in the wild (China, Henan, Luanchuan, Laojun Shan) **A, B** habitat **C** habit. Photographed by Wen-Qun Fei.

1996, 2007, 2008, 2013, 2015, 2016, 2018, 2019a, b, 2022; Yang 2000; Wang and Gilbert 2001; Wang and Liao 2009; Luo and Zhao 2013; Wang and Chen 2015; Wang et al. 2016; Yuan and Yang 2017a, b, c; Zhang et al. 2020; Fei et al. 2022, 2023a, b). New species of *Ranunculus* have been frequently found and described due to intensive field investigations of once not easily accessible areas (Wang 2022; Fei et al. 2023a, b).

During our botanical expedition in June 2022 to Laojun Shan in Luanchuan county, Henan province, central China, we encountered an unusual population of *Ranunculus* (Figs 1–4). The plants grow in a shady area among boulders and have prostrate stems,

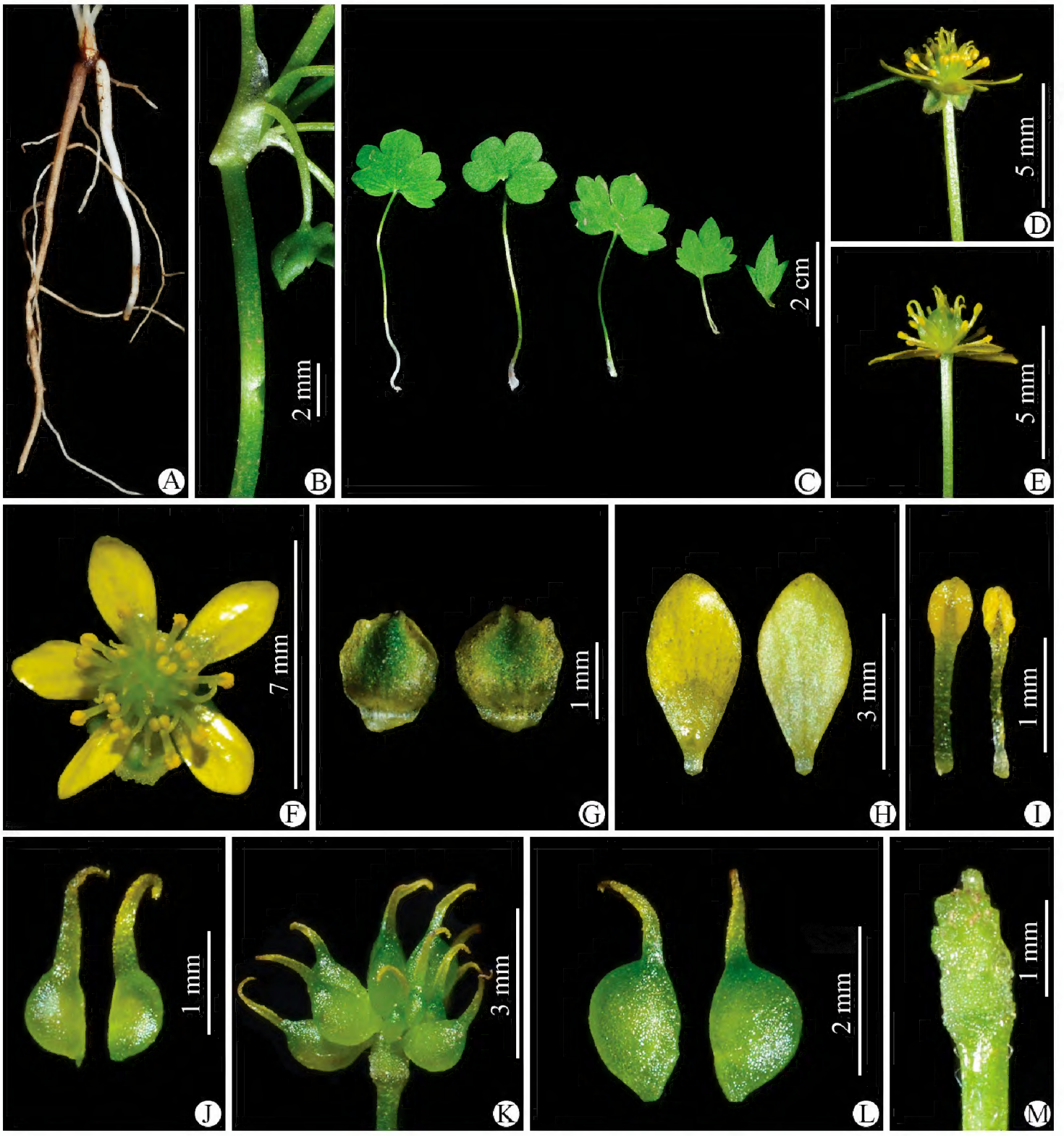

Figure 2. *Ranunculus luanchuanensis* sp. nov. in the wild (China, Henan, Luanchuan, Laojun Shan) **A** roots **B** portion of stem **C** leaves **D** flower with the sepals reflexed (lateral view) **E** flower with the sepals having fallen off (lateral view) **F** flower (top view) **G** sepal (left: abaxial side; right: adaxial side) **H** petal (left: adaxial side; right: abaxial side) **I** stamens **J** carpels **K** aggregate fruit **L** achenes **M** receptacle. Photographed by Wen-Qun Fei.

3-lobed and subreniform basal leaves, 3-lobed cauline leaves, small flowers with reflexed and caducous sepals, and glabrous carpels and achenes with long styles. They look like *R. limprichtii* Ulbr. (Figs 5–8) in having 3-lobed and subreniform basal leaves, 3-lobed cauline leaves (Figs 2C, 7C), small flowers (Figs 2D–F, 7D–F) with reflexed (Figs 2D, 7D) and caducous (Figs 2E, 7E) sepals, but differ by having slender and basally slightly thickened roots (vs. fusiform) (Figs 2A, 7A), prostrate stems (vs. erect) (Figs 1A, B, 6A, B), obliquely ovoid and glabrous carpels and achenes (vs. widely ovoid and puberulous)

Figure 3. Holotype sheet of *Ranunculus luanchuanensis* sp. nov.

(Figs 2J, L, 7J, L), longer styles in the carpels (ca. 1.2 mm vs. 0.6–0.8 mm) (Figs 2J, 7J) and achenes (ca. 1.8 mm vs. 0.6–0.8 mm) (Figs 2L, 7L), and glabrous receptacles (vs. sparsely puberulous) (Figs 2M, 7M). A detailed morphological comparison between the two species is given in Table 1. *Ranunculus limprichtii* is widely distributed in Gansu,

Figure 4. Isotype (**A–D**) sheets of *Ranunculus luanchuanensis* sp. nov.

Qinghai, Sichuan, Xizang (Tibet) and Yunnan, China (Fig. 9). Therefore, we determined that the population in question represents a hitherto undescribed species, which we name *R. luanchuanensis* and describe below.

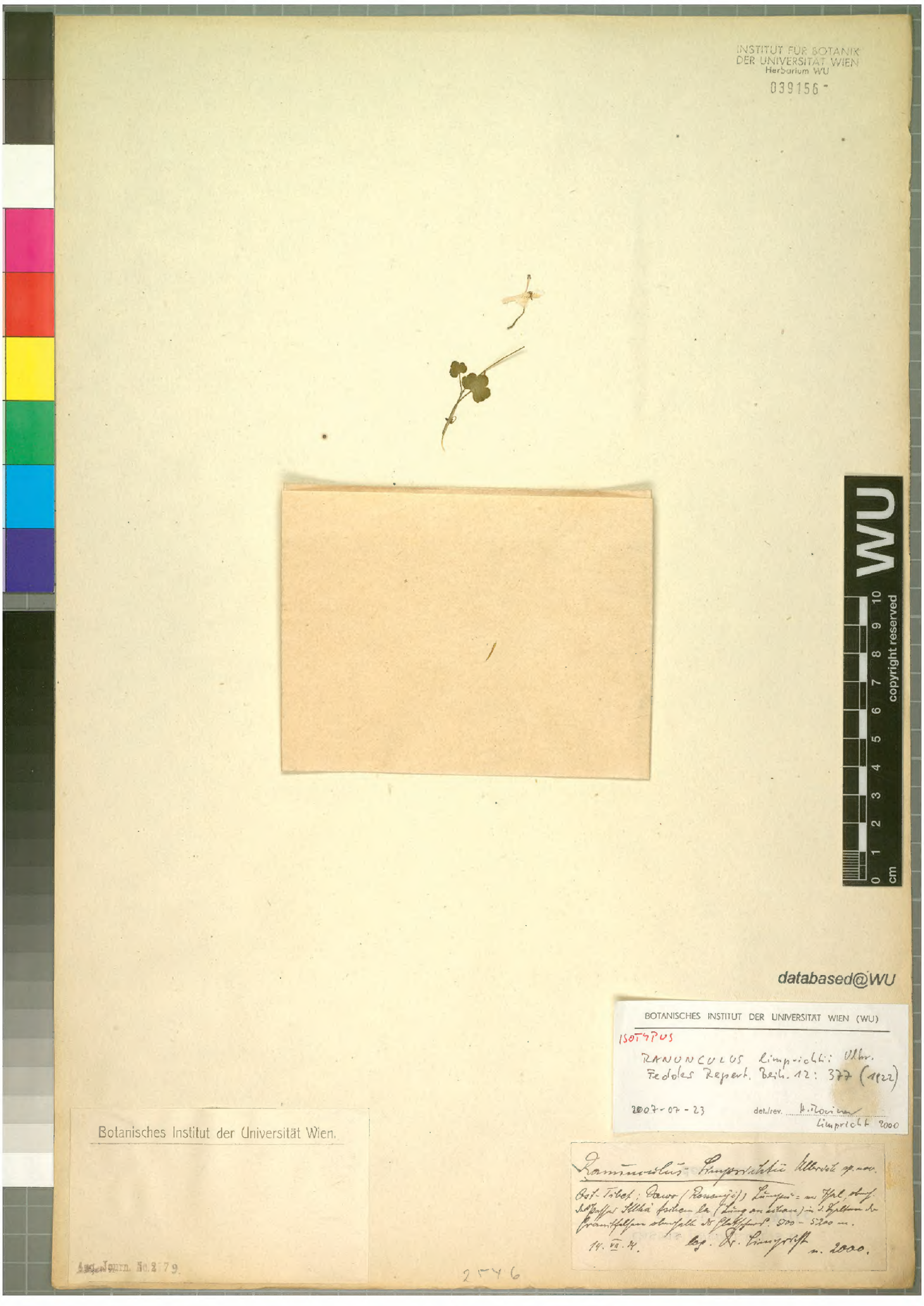

Figure 5. Isotype sheet of *Ranunculus limprichtii*. Note that the holotype was most probably destroyed during World War II.

Figure 6. *Ranunculus limprichtii* in the wild (China, Sichuan, Dawu, the type locality) **A, B** habitat **C** habit. Photographed by Wen-Qun Fei.

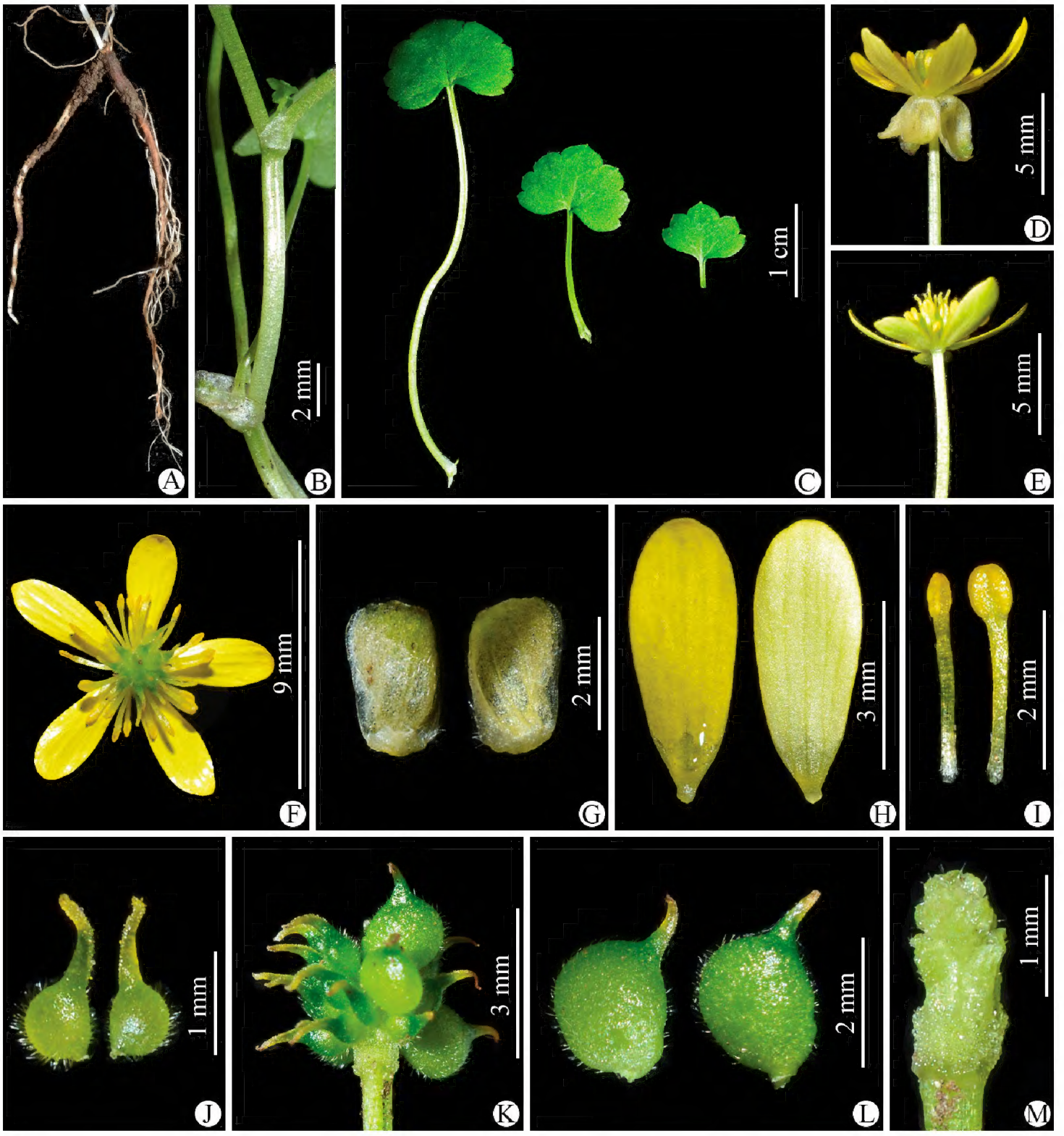

Figure 7. *Ranunculus limprichtii* in the wild (China, Sichuan, Dawu, the type locality) **A** roots **B** portion of stem **C** leaves **D** flower with the sepals reflexed (lateral view) **E** flower with the sepals having fallen off (lateral view) **F** flower (top view) **G** sepal (left: abaxial side; right: adaxial side) **H** petal (left: adaxial side; right: abaxial side) **I** stamens **J** carpels **K** aggregate fruit **L** achenes **M** receptacle. Photographed by Wen-Qun Fei.

Materials and methods

For morphological comparison, we examined physical specimens or high-resolution specimen images of *Ranunculus limprichtii* at CDBI, HNWP, KUN, PE and WU (acronyms according to Thiers 2022). We also observed living plants in one population of *R. limprichtii* (Dawu in Sichuan province, the type locality) and one population of *R. luanchuanensis* (Luanchuan in Henan province). The morphological description of *R. luanchuanensis* was based on the observation of herbarium specimens and living plants in the wild.

Figure 8. Selected specimens (**A, B**) of *Ranunculus limprichtii* from Dawu in Sichuan province, China (the type locality).

Taxonomy

Ranunculus luanchuanensis **W.Q.Fei, Q.Yuan & Q.E.Yang, sp. nov.**
urn:lsid:ipni.org:names:77314566-1
Figs 1–4

Diagnosis. The new species is morphologically similar to *R. limprichtii* in having 3-lobed and subreniform basal leaves, 3-lobed cauline leaves, and small flowers with reflexed and caducous sepals, but differs by having slender and basally slightly thickened roots (vs. fusiform), prostrate stems (vs. erect), obliquely ovoid and glabrous carpels and achenes (vs. widely ovoid and puberulous), longer styles in the carpels (ca. 1.2 mm vs. 0.6–0.8 mm) and achenes (ca. 1.8 mm vs. 0.6–0.8 mm), and glabrous receptacles (vs. sparsely puberulous).

Type. China. Henan province: Luanchuan county, Laojun Shan, 33°43'3.62"N, 111°38'59.89"E, in shady place among boulders on mountaintop, alt. 2077 m, 17 June 2022, *W.Q. Fei 588* (holotype: IBSC; isotypes: IBSC, PE).

Description. ***Herbs*** perennial, terrestrial or rupicolous. ***Roots*** 1–3, fibrous, slender, slightly thickened at base. ***Stems*** 12–20 cm long, prostrate, unbranched, glabrous. ***Basal leaves*** 2–6, 3-lobed, long petiolate; petioles 2–6 cm long, glabrous; blades 0.7–1.6 × 1–2.3 cm, subreniform in outline, thinly papery, adaxially green, glabrous or sparsely puberulous, abaxially light green, glabrous, base cordate, central segment 0.5–0.6 × 0.6–0.7 cm, widely obovate to rhombic-obovate, entire

or 2–3-dentate, apex rounded or acuminate, lateral segments 0.5–0.7 × 0.7–1 cm, obliquely flabellate, inconspicuously 2-lobed, apex rounded or acuminate. ***Lower cauline leaves*** 2–3, similar to basal ones but smaller. ***Upper cauline leaves*** 1–2, 0.6–1.2 × 0.3–0.8 cm, 3-lobed, rarely entire, shortly petiolate or subsessile, oblate-ovate, flabellate or lanceolate, glabrous. ***Inflorescences*** terminal, 1(–2)-flowered. ***Flowers*** 6–7 mm in diameter; pedicels 0.5–2 cm long, glabrous or sparsely puberulous; receptacles ca. 1 mm long, clavate, glabrous; sepals 5, 2–2.5 × 1.5–1.8 mm, elliptic to obovate, reflexed, caducous, green tinged with yellowish, concave, adaxially glabrous, abaxially sparsely puberulous; petals 5(–6), 3–3.5 × 1.5–1.8 mm, narrowly obovate, yellow, glabrous, apex obtuse or acuminate, nectary pit without a scale, claws ca. 0.4 mm long; stamens 12–16, filaments ca. 1.5 mm long, narrowly linear, anthers ca. 0.5 mm long, oblong; gynoecium subglobose; carpels 14–18, ovaries ca. 0.8 mm long, obliquely ovoid, laterally flattened, biconvex, glabrous, styles ca. 1.2 mm long, glabrous, apex recurved. ***Aggregate fruit*** ca. 3.5 × 3.5 mm, subglobose; achenes ca. 1.8 × 1.2 mm, obliquely ovoid, laterally flattened, biconvex, glabrous, styles ca. 1.8 mm long, persistent, apex recurved.

Etymology. The specific epithet refers to the type locality of the new species, i.e., Luanchuan county in Henan province, central China.

Phenology. Flowering in early June; fruiting at the end of June.

Distribution and habitat. *Ranunculus luanchuanensis* is currently known only from its type locality, i.e., Laojun Shan in Luanchuan county, Henan province, central China (Fig. 9). It grows in a shady area among boulders on a mountaintop at an altitude of 2077 m above sea level.

Conservation status. *Ranunculus luanchuanensis* is currently known only from one small population at its type locality, i.e., Laojun Shan in Luanchuan county, Henan province, central China. This population consists of ca. 100 individuals within an area of less than 3 m^2. However, the threat risk seems low because this species is not economically valuable and grows in a secluded place. The conservation status of *R. luanchuanensis* is here categorized as "Data Deficient (DD)" before adequate information on this species is acquired (IUCN Standards and Petitions Committee 2022).

Notes. Since its description, *Ranunculus limprichtii* var. *flavus* Hand.-Mazz. has been known only from its type material from Songpan county in Sichuan province, China (Wang 1995b). Based on our observations of herbarium specimens and living plants in the wild, we agree with Liou (1980) that this variety should be reduced to the synonymy of *R. limprichtii*. We will deal with the identity of *R. limprichtii* var. *flavus* in detail elsewhere.

According to Tamura's (1995) infrageneric classification of *Ranunculus*, *R. luanchuanensis* should be assigned to *R.* sect. *Ranunculus*, which is characterized by having swollen achenes with a distinct beak and receptacles hardly enlarged after anthesis. *Ranunculus limprichtii*, the putative closest ally of *R. luanchuanensis*, was placed by Wang (1995b) in *R.* sect. *Ranunculus*, with the section being incorrectly treated by him as *R.* sect. *Auricomus* (Spach) Schur. We accept the sectional placement of *R. limprichtii* since it is in accordance with the current placement of our new species in the same section.

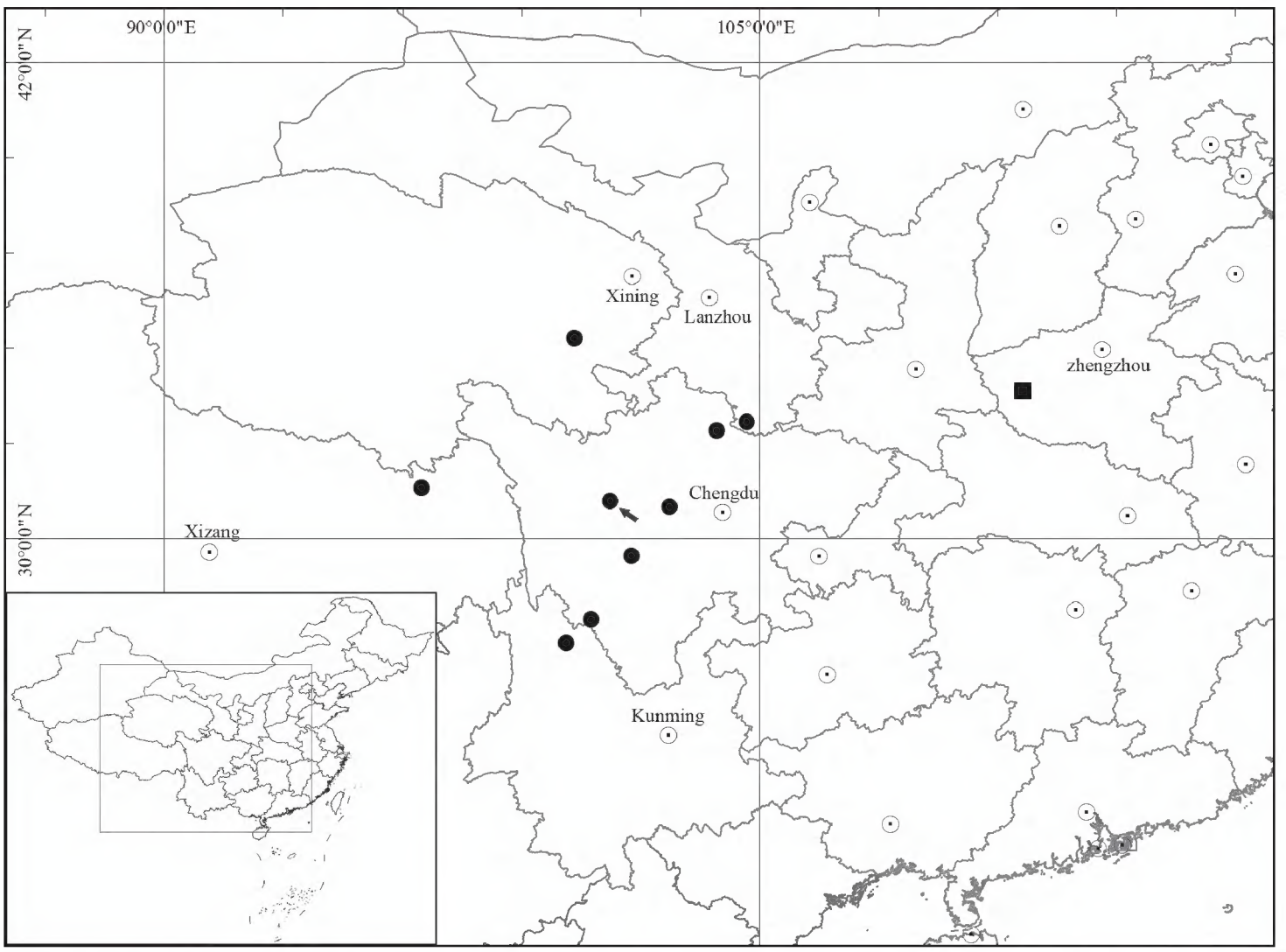

Figure 9. Distribution of *Ranunculus limprichtii* (black circle) and *R. luanchuanensis* sp. nov. (black square). Black arrow indicates the type locality of *R. limprichtii*, i.e., Dawu in Sichuan province, China.

Table 1. Morphological comparison between *Ranunculus limprichtii* and *R. luanchuanensis* sp. nov.

	R. limprichtii	***R. luanchuanensis***
Roots	1–3, fusiform	1–3, slender, slightly thickened at base
Stems	single, 7–10 cm tall, erect, glabrous or sparsely puberulous	single, 12–20 cm long, prostrate, glabrous
Basal leaves	1(–3)	2–6
Flowers	terminal, 1, 8–11 mm in diameter	terminal, 1(–2), 6–7 mm in diameter
Receptacles	ca. 1 mm long, clavate, sparsely puberulous	ca. 1 mm long, clavate, glabrous
Sepals	elliptic to obovate, abaxially sparsely puberulous	elliptic to obovate, abaxially sparsely puberulous
Petals	narrowly elliptic	narrowly obovate
Carpels	10–15; ovaries widely ovoid, puberulous; styles 0.6–0.8 mm long, apex recurved	14–18; ovaries obliquely ovoid, glabrous; styles ca. 1.2 mm long, apex recurved
Aggregate fruit	subglobose	subglobose
Achenes	widely ovoid, puberulous, styles 0.6–0.8 mm long	obliquely ovoid, glabrous, styles ca. 1.8 mm long

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References

Fei WQ, Yuan Q, Yang QE (2022) *Ranunculus huainingensis* and *R. lujiangensis* (Ranunculaceae), described from Anhui in China, are both synonymous with *R. ternatus*, a polymorphic eastern Asian species. Phytotaxa 573(1): 15–38. https://doi.org/10.11646/phytotaxa.573.1.2

Fei WQ, Yuan Q, Yang QE (2023a) *Ranunculus jiguanshanicus* (Ranunculaceae), a new species from Sichuan, China. PhytoKeys 219(2): 57–75. https://doi.org/10.3897/phytokeys.219.96266

Fei WQ, Yuan Q, Yang QE (2023b) *Ranunculus maoxianensis* (Ranunculaceae), a new species from northwestern Sichuan, China, with an emended description of *R. chongzhouensis*, the putative closest ally of the new species. PhytoKeys 219(2): 77–96. https://doi.org/10.3897/phytokeys.219.96510

Hörandl E, Emadzade K (2012) Evolutionary classification: A case study on the diverse plant genus *Ranunculus* L. (Ranunculaceae). Perspectives in Plant Ecology, Evolution and Systematics 14(4): 310–324. https://doi.org/10.1016/j.ppees.2012.04.001

Hörandl E, Paun O, Johansson JT, Lehnebach C, Armstrong T, Chen L, Lockhart P (2005) Phylogenetic relationships and evolutionary traits in *Ranunculus* s.l. (Ranunculaceae) inferred from ITS sequence analysis. Molecular Phylogenetics and Evolution 36(2): 305–327. https://doi.org/10.1016/j.ympev.2005.02.009

IUCN Standards and Petitions Committee (2022) Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. IUCN Standards and Petitions Committee. https://www.iucnredlist.org/documents/RedListGuidelines.pdf

Liou L (1980) *Ranunculus* L. In: Wang WT (Ed.) Flora Reipublicae Popularis Sinicae Vol. 28. Science Press, Beijing, 255–331.

Luo MR, Zhao L (2013) A new *Ranunculus* species (Ranunculaceae) from Shaanxi, China. Bangladesh Journal of Plant Taxonomy 20(2): 201–205. https://doi.org/10.3329/bjpt.v20i2.17394

Paun O, Lehnebach C, Johansson JT, Lockhart P, Hörandl E (2005) Phylogenetic relationships and biogeography of *Ranunculus* and allied genera (Ranunculaceae) in the Mediterranean region and in the European alpine system. Taxon 54(4): 911–930. https://doi.org/10.2307/25065478

Tamura M (1995) Angiospermae. Ordnung Ranunculales. Fam. Ranunculaceae. II. Systematic Part. In: Hiepko P (Ed.) Die Natürlichen Pflanzenfamilien, 2nd edn. Vol. 17aIV. Duncker & Humblot, Berlin, 223–519.

Thiers B (2022) Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff. http://sweetgum.nybg.org/science/ih/ [accessed 2 December 2022]

Wang WT (1995a) A revision of the genus *Ranunculus* in China (I). Bulletin of Botanical Research 15(2): 137–180.

Wang WT (1995b) A revision of the genus *Ranunculus* in China (II). Bulletin of Botanical Research 15(3): 275–329.

Wang WT (1996) Notulae de Ranunculaceis Sinensibus (XIX). Bulletin of Botanical Research 16(2): 155–166.

Wang WT (2007) *Ranunculus ailaoshanicus* W. T. Wang, a new species of Ranunculaceae from Yunnan, China. Zhiwu Fenlei Xuebao 45(3): 293–295. https://doi.org/10.1360/aps06192

Wang WT (2008) New taxa of Ranunculaceae from Yunnan. Yunnan Zhi Wu Yan Jiu 30(5): 519–524.

Wang WT (2013) Six new species and two new varieties of Ranunculaceae from southwest China. Guangxi Zhi Wu 33(5): 579–587.

Wang WT (2015) Five new species of *Ranunculus* from west China. Bulletin of Botanical Research 35(5): 641–646.

Wang WT (2016) Six new species of Ranunculaceae from China. Guangxi Zhi Wu 36(11): 1303–1311.

Wang WT (2018) *Ranunculus lujiangensis*, a new species of Ranunculaceae from Anhui Province. Bulletin of Botanical Research 38(6): 801–803. https://doi.org/10.7525/j.issn.1673-5102.2018.06.001

Wang WT (2019a) *Ranunculus kangmaensis* W. T. Wang, a new species of Ranunculaceae from Tibet of China. Guangxi Zhi Wu 39(3): 285–287. https://doi.org/10.11931/guihaia.gxzw201712013

Wang WT (2019b) Two new species of *Ranunculus* from Tibet, China. Guangxi Zhi Wu 39(9): 1139–1342. https://doi.org/10.11931/guihaia.gxzw201811047

Wang WT (2022) Five new species and one new variety of *Ranunculus* (Ranunculaceae) from Sichuan, with one new section represented by one of these species. Guihaia 42(1): 1–9. https://doi.org/10.11931/guihaia.gxzw202011047

Wang WT, Chen SR (2015) *Ranunculus laohegouensis*, a new species of Ranunculaceae from Sichuan. Bulletin of Botanical Research 38(6): 801–802. https://doi.org/10.7525/j.issn.1673-5102.2015.06.001

Wang WT, Gilbert MG (2001) *Ranunculus* Linnaeus. In: Wu ZY, Raven PH, Hong DY (Eds) Flora of China Vol. 6. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis, 391–431.

Wang WT, Liao L (2009) *Ranunculus napahaiensis*, a new species of Ranunculaceae from Yunnan, China. Guihaia 29(4): 427–429.

Wang WT, Yang Z, Xie J (2016) *Ranunculus huainingensis*, a new species of Ranunculaceae from Anhui. Guihaia 36(supplement 1): 97–99.

Yang QE (2000) *Ranunculus wangianus* Q. E. Yang, a new species from NW Yunnan, China and its karyotype. Acta Phytotaxonomica Sinica 38(6): 551–556.

Yuan Q, Yang QE (2017a) *Ranunculus angustisepalus* (Ranunculaceae) is an *Oxygraphis* and conspecific with *O. delavayi*. Phytotaxa 319(1): 103–110. https://doi.org/10.11646/phytotaxa.319.1.6

Yuan Q, Yang QE (2017b) The identity of *Ranunculus ailaoshanicus* (Ranunculaceae) from China. Phytotaxa 319(1): 111–117. https://doi.org/10.11646/phytotaxa.319.1.7

Yuan Q, Yang QE (2017c) The identity of *Ranunculus laohegouensis* (Ranunculaceae) from Sichuan, China. Phytotaxa 324(2): 198–200. https://doi.org/10.11646/phytotaxa.324.2.9

Zhang M, Zeng YP, Yang QE (2020) *Ranunculus kangmaensis* (Ranunculaceae), a new synonym of *Halerpestes tricuspis* var. *variifolia*. Phytotaxa 434(1): 101–112. https://doi.org/10.11646/phytotaxa.434.1.7